Development of a Ballast Water Treatment Technology Verification Protocol Through an Interagency/Private Partnership

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The Issue

The global economy is highly dependant on shipping for the transport of consumer goods and life sustaining commodities. All modern ships use water as ballast to provide vessel trim and stability during a voyage, and it is common for vessels to frequently deballast and reballast during cargo loading and unloading operations. Globally, 3 to 5 billion metric tons of ballast water are discharged annually. The United States alone receives at least 2 billion gallons of ballast water each year from around the world resulting from coastal or in-port ballast water discharges. Although vital to the safe operation of the vessel, ballast water also contains thousands of aquatic organisms in various life stages, in addition to bacteria and viruses. Some of this incidental biological cargo which is taken up with the ballast water in a port of origin can survive the voyage and is discharged into new environments in the destination ports. These non-indigenous species may find conditions favorable enough to allow proliferation resulting in ecological damage or in sever cases complete loss of native species and habitats.

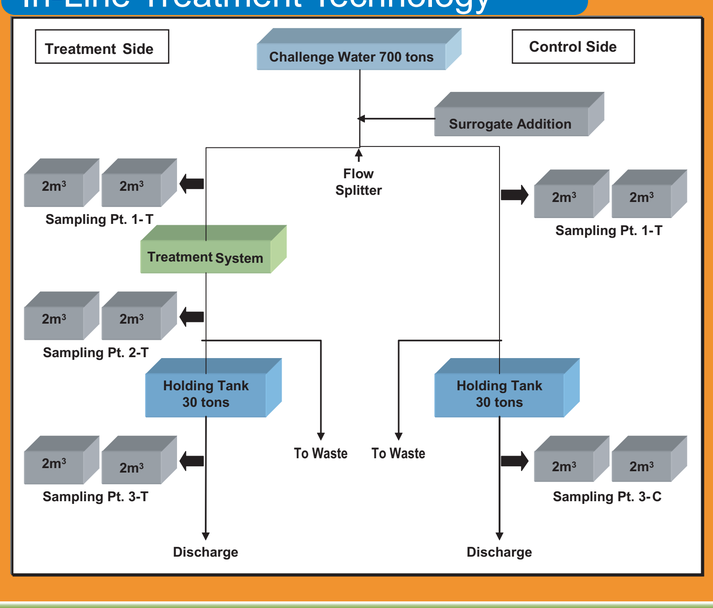
Abstract

The introduction of aquatic nuisance species (ANS) through the discharge of ballast water into coastal areas around the world has had profound negative impacts on aquatic ecosystems worldwide. ANS is considered one of the most important environmental issues facing the marine community. In recent years, responsible governments have given attention to the problem by initiating research into ballast water management techniques such as deep water exchange, and more recently, the development and application of shipboard ballast water treatment technology. Currently, workgroups under the International Maritime Organization (IMO) are proposing ballast water discharge standards that are driving new technology development. Issues surrounding ballast water treatment technologies that remain to be resolved include the specifics of approved treatment standards and processes for certifying the technologies. To address the need for the development of certifying procedures and technology performance verification, the U.S. Environmental Protection Agency and the U.S. Coast Guard are jointly developing a protocol to verify the technical performance characteristics of full-scale commercial ready technologies designed to treat ship ballast water. This effort was initiated in June of 2001 by the two agencies under EPA's Environmental Technology Verification (ETV) Program, and is managed by a team consisting of program managers from the ETV Program's Water Quality Protection Center (WQPC) in Edison, New Jersey, and the U.S. Coast Guard's National Ballast Water Management Program in Washington, D.C. Technical assistance is provided by the National Sanitation Foundation (NSF) International, Ann Arbor, MI, as the verification partner organization for the WQPC. Battelle's Coastal Resources and Environmental Management Group from Duxbury, MA, was also contracted to write the draft protocol including supporting documents and facilitate technical meetings. The protocol is being developed with extensive input from a ballast water stakeholders group and a technical panel that includes representatives from the developing ballast water technology industry, federal and state agencies, non-government agencies, and research scientists involved in the ballast water and aquatic invasive species issue. The ETV Program is also developing a partnership with the Singapore's Institute of Environmental Science and Engineering (IESE) to establish a parallel technology verification capability. During the past two years the U.S. Coast Guard in cooperation with the U.S. Navy developed a facility to conduct full-scale ballast water technology verification tests in accordance with the requirements of the ETV protocol. The facility, to be completed in the Summer of 2005, is located at the Naval Research Laboratory on Key West, FL, and will provide an opportunity to pilot test the protocol later this year.

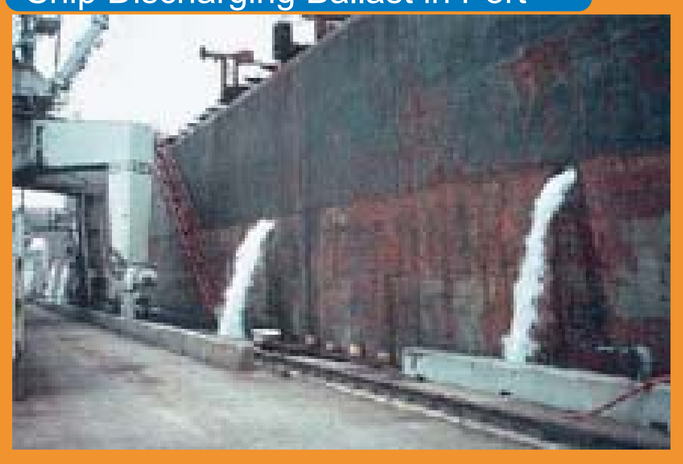
Approach

The protocol defines ballast water treatment systems as: "prefabricated, commercial-ready treatment systems designed to remove, kill or inactivate organisms that are potentially harmful to human health and receiving ecosystems from ballast water prior to discharge". The definition includes both in-line and in-tank treatment systems. The protocol includes design flexibility to accommodate systems that may conduct treatment through single or multi-step processes. As directed by the participating stakeholders, the protocol will verify treatment systems for: (1.) Biological treatment performance; (2.) Operation and maintenance; (3.) Reliability; (4.) Cost factors; (5.) Environmental acceptability, and; (6) Safety factors. Challenge water quality will be adjusted to provide a difficult, but not impractical media. Biological species will include both ambient organisms and a series of surrogates representing Zooplankton, Phytoplankton, Protist, and Bacteria. Research is currently being conducted to determine the most appropriate surrogate(s). An important aspect of the protocol is the identification of appropriate biological methods and standard operating procedures (SOP) that can be used all testing locations. Early in the protocol development, it became evident that methods used by the ballast water research community were not consistent. A significant effort was initiated to provide appropriate methods and SOPs as supporting documents to the protocol. A workshop to address these issues was convened and the resulting draft documents will be used part of the pilot testing later this year.

In-Line Treatment Technology



Ship Discharging Ballast in Port



In-Tank Treatment Technology